

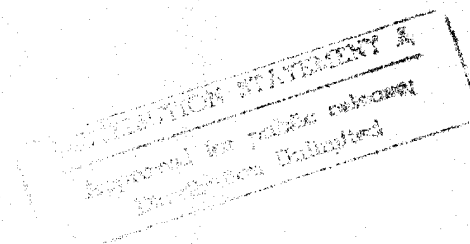
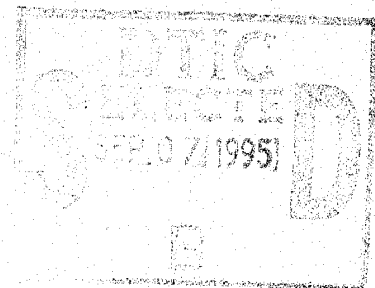
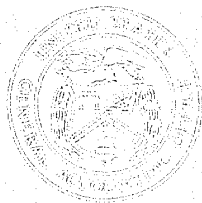
GAO

Report to the Administrator  
Environmental Protection Agency

July 1992

SUPERFUND

EPA Cost Estimates  
Are Not Reliable or  
Timely

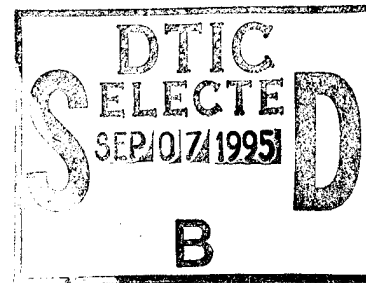


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Accounting and Financial  
Management Division

B-248034

July 1, 1992

The Honorable William K. Reilly  
Administrator, Environmental  
Protection Agency

Dear Mr. Reilly:

The Environmental Protection Agency's (EPA) Superfund program is one of 16 federal programs we consider most vulnerable to a high risk of material loss of government resources. The Congress' Superfund spending authorization increased from \$1.6 billion in 1980, when the fund was established, to \$15.2 billion to fund hazardous waste site cleanup projects through 1994. In February 1992, EPA issued its fiscal year 1990 Superfund report, which estimated the program will cost \$27.2 billion. Because of the likelihood that the Congress will be requested to authorize additional billions of dollars to clean up hazardous waste sites, we examined whether EPA's reporting of Superfund's estimated funding needs is reasonable.

## Results in Brief

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EPA's Superfund cost estimates are not reliable or useful as a tool to oversee costs or to make funding decisions. EPA is often a year or more late in issuing its legislatively required annual cost estimate for the Superfund program, which lessens its usefulness to the Congress. Also, EPA's estimates for fiscal years 1989 and 1990 did not (1) include billions of dollars for cleaning up sites which historical evidence indicates will be placed on the national priorities list (NPL) during the next several years or (2) reflect realistic costs associated with completing ongoing cleanup at current hazardous waste sites.

EPA's Chief Financial Officer (CFO) has not been given a strong role in ensuring that the annual forecast of Superfund's eventual costs is reliable, and its Inspector General (IG) has not analyzed the reasonableness of those estimates as part of the IG's statutorily required reviews of EPA's annual Superfund report and financial statements.

Although EPA disagreed with our recommendations, we believe that they constitute a reasonable approach for generating reliable and timely cost projections. Such an approach would serve to fully disclose potential Superfund implementation costs, thus helping the Congress in making decisions to provide additional hazardous waste cleanup funding authorizations and assessing the fund's ultimate financial requirements.

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## Background

Thousands of waste disposal sites across the country have been contaminated with hazardous substances which threaten public health and the environment. Under current legislation, the funding is to be paid by those responsible for the pollution. However, based on experience to date, the federal government undoubtedly will ultimately pay a large portion of these costs.

The Congress' commitment to solving this immense and costly problem resulted in the passage of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). CERCLA authorized EPA to clean up the nation's most hazardous abandoned waste sites. The act created a 5-year, \$1.6-billion trust fund to pay for federal cleanup if responsible parties could not be located, were unwilling, or were unable to clean up the sites. The fund, formally designated as the Hazardous Substance Response Trust Fund, is commonly known as the Superfund, and the organizational structure created by EPA to comply with CERCLA is known as the Superfund program. EPA's Office of Solid Waste and Emergency Response is responsible for overseeing the Superfund program.

In 1986, the Superfund Amendments and Reauthorization Act, reauthorized the Superfund program for another 5 years and an additional \$8.5 billion for the trust fund. The 1986 reauthorization established more stringent requirements for the program, stressing permanent remedies and thorough treatments for cleaning up hazardous waste sites. More recently, the Omnibus Budget Reconciliation Act of 1990 extended the Superfund program through 1994 and increased the trust fund by \$5.1 billion to a total of \$15.2 billion in spending authority.

Financing for the trust fund is primarily derived from a tax on crude oil and certain chemicals, such as arsenic and mercury, and an environmental tax on corporations. Other financing sources include repayable advances from the general fund of the U.S. Treasury, costs recovered from responsible parties, fines and penalties paid by hazardous waste violators, and interest earned on invested funds. Superfund accounts for 25 percent of EPA's budget.

Superfund costs relate only to the cost of cleaning up hazardous waste sites, as financed by the sources just identified. There are additional costs to clean up NPL sites that are directly borne by private parties responsible for the sites, as well as costs paid by state governments. EPA's annual Superfund cost estimates do not include nonfederal costs or costs funded

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through other agencies, such as the Departments of Defense and Energy, to clean up hazardous waste sites for which they are responsible.

EPA ranks hazardous waste sites according to the severity of the waste problem and places only the worst on its NPL for Superfund cleanup. After a site is brought to EPA's attention, EPA conducts a preliminary study to determine the severity of its contamination and its eligibility for priority listing.

There are two types of Superfund-financed cleanups: removal actions and remedial actions. Removal actions are short-term responses to immediate and significant threats at a hazardous waste site, regardless of whether the site is on the NPL. Remedial actions<sup>1</sup> are long-term cleanup efforts intended to mitigate or permanently eliminate hazardous waste conditions at NPL sites.

To ensure appropriate remedial cleanup actions, EPA conducts an investigation and a feasibility study for each NPL site to identify the types and quantities of hazardous wastes present and to consider alternative remedies for cleaning up the waste. It then chooses a remedy for implementation and develops an action plan referred to as a record of decision.

As of October 1991, EPA had an inventory of about 1,200 NPL sites scheduled for hazardous waste cleanup. According to Superfund program data, EPA cleaned up 63 sites on the NPL from 1981 through October 1991. As of October 1991, cleanup work was in progress at 353 NPL sites, study or design work was ongoing at 742 sites, and no action had been taken on 87 others.

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## Objectives, Scope, and Methodology

To provide the Congress and others with useful information on the expected cost of the high-risk Superfund program, our objectives were to determine whether EPA's (1) Superfund cost estimates result in reliable and timely projections and (2) CFO and IG are involved in evaluating the reasonableness and reliability of the estimates.

We reviewed the laws that established and increased Superfund funding authorizations and EPA financial information on the fund's expenditures for

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<sup>1</sup>Examples of remedial actions include excavation of contaminated soil, groundwater pumping, and incineration.

the past 10 fiscal years. In order to evaluate the quality of EPA's cost estimating procedures, we reviewed how it developed the 1989 cost estimate, the most recent at the time we ended our audit work. We also examined selected aspects of the 1990 Superfund report to ascertain whether the same general methodology was used for the 1990 estimate.

We analyzed EPA's overall basis for making the estimates and examined the underlying factors supporting EPA's cost determinations. We discussed how the estimates are calculated with staff who developed and maintain a computer model which produces the estimates.

We interviewed EPA program staff to determine the number of sites they expected to add to the NPL in the next 10 years. We requested EPA to estimate costs for cleaning up sites EPA expects to be added for the next 10 years but did not verify the estimate. We also examined private sector and academic studies pertaining to Superfund cleanup costs, but did not review the methodology used in those studies. These studies are cited in the bibliography.

We discussed with Superfund program and EPA Comptroller representatives their respective roles in developing estimates of future Superfund costs. We reviewed the Chief Financial Officers Act of 1990 (Public Law 101-576) and the Office of Management and Budget's (OMB) guidance related to agency CFO responsibilities. We also reviewed the scope and results of the IG's audit of the 1989 Superfund report to the Congress.

Our work was conducted at EPA headquarters in Washington, D.C., and its regional office in Kansas City, Kansas, between November 1990 and January 1992, in accordance with generally accepted government auditing standards.

EPA and EPA's Inspector General provided written comments on a draft of this report. These comments are included in appendixes III and IV, respectively.

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## Superfund Cost Estimates Are Substantially Understated and Late

EPA's fiscal year 1989 estimate of the future federal cost of cleaning up abandoned hazardous waste sites through Superfund was almost a year late and seriously understated because EPA has not established a cost estimating approach that is reliable. CERCLA requires EPA to annually report to the Congress an estimate of the costs needed to complete Superfund implementation, which EPA interprets as covering the cost of completing cleanups of existing NPL sites. However, EPA's estimates are incomplete because they (1) do not include billions of dollars related to cleaning up additional waste sites that in all probability will be added to the NPL during the next several years, (2) use a cost growth rate which is unsupported and may be far too low, and (3) are prepared without using certain forecast management techniques, such as identifying forecast errors. Unless EPA's cost estimates to complete hazardous waste cleanup are improved, the Congress will not have a sound basis for deciding future Superfund funding levels, which could be materially greater than the Congress has currently authorized or anticipates.

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## Cost Estimates Exclude Future NPL Sites

EPA's estimates did not include all the sites it intended to add to the NPL over the next few years. EPA's 1989 report to the Congress under CERCLA estimated that \$26.4 billion would be necessary to complete Superfund cleanup. This included \$6 billion incurred through fiscal year 1989 and estimated future costs of \$20.4 billion related to cleaning up almost 1,200 sites which were on the NPL during that year. Also, fiscal year 1990's estimate included only costs related to sites currently on the NPL.

However, EPA officials knew that costs would be much greater. By assuming that no new sites would be added to the NPL, EPA, in effect, ignored historic program growth. EPA's Office of Solid Waste and Emergency Response officials told us that 1,000 sites could be added to the NPL by the year 2000, but costs for cleaning these sites were not included in the 1989 estimate. EPA's estimate of an additional 1,000 sites is consistent with its experience of adding an average of 112 sites annually during the 1980s. Thus, the number of sites on the NPL continues to grow because sites are added at a much faster rate than cleanups are completed.

EPA told us it excludes sites not currently on the NPL in making the estimates because it believes the estimates are supposed to include only costs for sites currently on the list. While CERCLA's requirement to report completion cost estimates is not specific as to what must be included, EPA's interpretation, as conveyed by the 1989 estimate, does not fully reflect the government's exposure.

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Estimates based on historical program growth would provide the Congress with a more realistic reflection of the cost of hazardous waste cleanup over the next several years. In addition, it would be reasonable to categorize the sites and show a breakdown between those sites currently on the NPL, those to be added over a certain period, such as the next 10 years, and those to be added in the more distant future.

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### Cost Growth Factor Is Unsupported and Often Exceeds Estimates

Long-term treatment, cleanup, and rehabilitation of sites already on the NPL, referred to as remedial action costs, have not been estimated with a high degree of certainty. These costs, which increase annually, constitute about 30 percent, or almost \$6 billion, of EPA's \$20.4 billion 1989 estimate of future Superfund costs. (See appendix I.)

Once remedial actions are underway, actual costs frequently exceed initial cost estimates established prior to the start of cleanup work. Sites are often found to be more seriously contaminated than first believed, thus significantly increasing the amount of work and treatment technology required.

Because of these uncertainties, EPA includes a cost growth factor in preparing remedial action cost estimates. In computing 1989's remedial action costs, EPA applied a cost growth factor of 25 percent to the \$4.8 billion base cost for completing remedial actions, thereby arriving at \$6 billion in total cost. EPA developed its 1990 cost estimate using cost factors that were consistent with those used in developing the 1989 cost estimate.

However, the cost growth factor EPA uses may be far too low. Primarily because EPA does not maintain financial information that compares budgeted and actual cleanup costs, EPA's basis for the level of growth used in making its estimates is unsubstantiated. The 25 percent factor was adopted in 1987 and has not been refined based on actual cost experience.<sup>2</sup> It is more of a "guesstimate" than an estimate and is not based on hard data.

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<sup>2</sup>While we did not review the methodology used, hazardous waste cleanup studies and analyses done by others indicate that cost growth for these projects can range from 39 to 79 percent. See studies cited in the bibliography which are authored by (1) Thomas L. Richardson, Paul Dappen, and Michael C. Ray, (2) Brett R. Schroeder, (3) Brett R. Schroeder and Ralph Shangraw, and (4) Carolyn B. Doty, Amelia G. Crotwell, and Curtis C. Travis.

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EPA does not accumulate costs and systematically compare actual to estimates to verify and refine, where necessary, its cost growth rate. This type of analysis is critical to overseeing costs of the program. EPA, knowing it needed to include some number for cost growth, selected a starting point but has only recently begun to analyze the reasonableness of the initial factor adopted for reporting.

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**Available Forecast  
Management Techniques  
Are Not Used**

The lack of cost information notwithstanding, EPA does not use a number of possible forecast management techniques to assist in preparing cost estimates. While estimating future costs by its very nature is imprecise, certain estimating techniques can increase the validity of cost estimates, if appropriately used. These include identifying forecast errors, developing an events register, using sensitivity analysis, and establishing quality control techniques. Appendix II further discusses these techniques and suggests how they can be used by EPA in estimating costs to clean up Superfund sites.

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**Total Costs Could Be  
Materially Greater Than  
EPA Reported**

Total Superfund costs could far exceed the \$15.2 billion the Congress has authorized for Superfund and the \$26.4 billion EPA advised the Congress would be necessary for hazardous waste cleanup. To provide some order of magnitude, EPA advised us that another \$11 billion would be needed for the 1,000 sites expected to be added to the NPL through the year 2000. Also, EPA's \$26.4 billion estimate includes an estimated \$6 billion for remedial actions. If a 50 percent cost growth factor was ultimately found to be more representative, \$1.2 billion<sup>3</sup> would be added to the estimate derived using the 25 percent growth factor.

Also, the federal government's costs to clean up NPL sites depends largely on the extent to which total site cleanup costs are paid by those responsible for the pollution. To recognize this situation, the 1989 estimate assumes that potentially responsible parties will finance 55 percent of new cleanup actions and that by fiscal year 1997 these parties will pay for 65 percent. According to information in EPA's fiscal year 1990 Superfund report, recent trends indicate that financing of cleanups by responsible parties has increased during the past 4 years. If this trend continues,

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<sup>3</sup>In making this computation, we first deducted from EPA's \$6 billion remedial action cost estimate the 25 percent, or \$1.2 billion, growth factor EPA used. We then multiplied the result, which was \$4.8 billion, by 50 percent, which calculated remedial action cost growth to be \$2.4 billion, or \$1.2 billion more than EPA's total estimate.

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Superfund costs could decrease. The reverse is possible, as well. In either case, including in the estimates only costs for sites currently on the NPL may represent the tip of the iceberg of potential costs.

To better track estimated and actual cleanup costs, EPA is revising its method of estimating Superfund costs by reviewing planning assumptions and modifying the information system it uses to project Superfund costs. These actions were being developed at the time of our review, but it was too early to assess the results. However, EPA does not plan to include in its estimates the costs for future sites not yet on the NPL. We believe this results in unrealistically low and misleading data for the Congress. As stated earlier, EPA could certainly aggregate the costs by category, but to disregard altogether EPA's historical experience of adding new sites to the NPL greatly reduces the value of the cost estimates.

Reporting reliable Superfund cost estimates would be in accord with the Chief Financial Officers Act of 1990. The act calls for useful financial information to help agencies manage programs. Further, the CFO Act requires agency financial management systems to report cost information for analyzing financial operations and provide for the systematic measure of performance. It would be much more useful and informative if the report presented a complete picture of Superfund costs and disclosed the cost of the fund's operations in comparison to these projections.

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### Annual Report Is Often Issued Late

The usefulness of EPA's Superfund report, which includes the estimated cleanup costs, is further diminished because it is issued late. CERCLA requires EPA to report annually to the Congress on its response activities and accomplishments and an estimate of the costs needed to complete Superfund implementation.

The 1989 report was due to the Congress January 1, 1990, but was issued almost a year later, in December 1990. The 1990 report, due January 1, 1991, was issued in February 1992, more than a year late.

EPA's Inspector General has reported on the untimeliness of the 1988 and 1989 reports and plans another, overall report on the timeliness issue. The IG attributed the 1989 report's delay to the report coordinator devoting much of his time to the previous year's report. The report coordinator agreed with the IG's assessment and also attributed the delays to the voluminous data required to be included in the report.

## The CFO and IG Do Not Monitor the Reliability of Superfund Cost Estimates

EPA's CFO does not have a strong role in developing, and the IG has not reviewed the reliability of, Superfund cost estimates prepared by program managers. The CFO Act requires that an agency CFO oversee all financial management activities relating to the programs and operations of the agency. In this regard, OMB's guidance to agencies for implementing the act states that a CFO should have authority to review programmatic proposals in order to advise agency heads in areas such as program cost estimates. CERCLA requires the IG to review EPA's annual Superfund reports, which disclose the annual cost estimates. Without close monitoring of Superfund cost estimates by the CFO and the IG, the reliability of these estimates and full accountability for Superfund operations is uncertain.

Preparing cost estimates to complete hazardous waste site cleanup is the responsibility of the Superfund program managers. While this is an appropriate function for Superfund managers, there is an important role, as envisioned by the CFO Act and related OMB guidance, for EPA's CFO to provide guidance and oversight review of the estimates and the estimating methods used, since Superfund constitutes 25 percent of EPA's budget.

The CFO also has a direct interest in ensuring that cleanup cost estimates prepared by Superfund program managers are reliable and timely. The CFO Act requires EPA's CFO to prepare an annual report to the Administrator and OMB which is to include a description and analysis of EPA's financial management. This report, which is available to the Congress and the public, can be a vehicle for presenting information on future funding requirements for agency programs, such as the Superfund's hazardous waste cleanup program.

The CFO's annual report is intended to provide useful financial information to the Congress, such as a perspective on funding levels and estimated costs of Superfund. This type of relevant financial information can assist the Congress in deciding when and whether to increase funding authorization for the program, and whether to increase financing for the trust fund.

Further, having reliable cost estimates would enable the Superfund report's financial information to be more useful to EPA managers in conducting financial analyses. For instance, they would be able to (1) track and compare the estimates over a period of time, (2) analyze the estimates in relation to actual costs as a tool in measuring performance, and

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(3) identify upward or downward trends in relation to the results achieved and the magnitude of the job to be completed.

Although the role of EPA's CFO is still evolving, EPA's CFO organization plan, which was approved by OMB, does not assign the CFO responsibility for reviewing the annual estimate. At the conclusion of our audit work, EPA had not developed a position on whether its CFO would have responsibility for oversight of these cost estimates.

EPA's IG also has an important role to ensure the reliability of Superfund cost estimates. As required by CERCLA, EPA's IG reviewed and reported on EPA's fiscal year 1989 Superfund report to the Congress. The scope of that report included audit work to verify the accuracy of selected information presented in the report, but not the estimated costs to clean up NPL sites. The IG did not include the fiscal year 1990 estimate in the scope of its review of the Superfund report because our audit was in progress.

The IG's May 1991 semiannual report states that the IG plans to audit the Superfund's financial statements, as the CFO Act requires. Under OMB's September 10, 1991, guidance (Bulletin 91-15), financial statements issued under the act are to include an overview discussion and analysis of an entity's financial condition, which discusses programs or activities that may need significant future funding. Therefore, it is appropriate for the Superfund's financial statement overview to disclose information on the estimated cost to complete hazardous waste site cleanup.

As part of the IG's financial audit, it would be necessary to examine the Superfund cost estimate's adequacy. In this connection, OMB Bulletin 91-14 requires that financial audits determine whether an agency has adequately documented and supported financial, statistical, and other information presented in a financial statement overview. Further, OMB requires that financial audits also examine the adequacy of systems from which such information is derived.

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## Conclusions

The usefulness of reports to the Congress on Superfund's expected costs can be improved by refining the estimates in a number of ways, such as including the costs associated with cleanup sites expected to be placed on the NPL during the next several years. These costs can be stratified by reporting estimated costs of (1) sites on the NPL, (2) sites expected to be added to the NPL in the next several years, and (3) those to be added in the more distant future. In addition, using a reasonable cost growth factor and

forecast measurement practices, such as identifying forecast errors, would bolster the estimate's reliability. The reliability and timeliness of Superfund cost estimates can be improved also by giving EPA's CFO a strong role in monitoring the estimates reported to the Congress. In addition, disclosing future Superfund costs in the Fund's annual financial statement overview, which OMB requires agencies to prepare under the CFO Act, would help ensure that the cost estimates are reasonable because the IG would have to assess them as part of the annual financial audit.

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## Recommendations

To improve the usefulness of estimates to complete hazardous waste site cleanup, we recommend that the Administrator require the Assistant Administrator for Solid Waste and Emergency Response to (1) report the estimates in categories showing those currently on the NPL, those to be added over a certain period, such as the next 10 years, and those to be added in the more distant future, (2) substantiate and document as reasonable, the factor used in preparing the estimates to reflect the growth in the cost of cleanup projects underway, and (3) use forecast management practices, such as identifying forecast errors, in developing the estimates. (See appendix II.)

To help ensure the reliability and timeliness of Superfund cost estimates, we recommend that the Administrator (1) provide the CFO authority and responsibility, as envisioned in the CFO Act, for providing guidance on preparing the estimates and monitoring the results and (2) direct the CFO to disclose in the Superfund financial statement overview, information on the estimated cost of hazardous waste site cleanup.

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## Agency Comments and Our Evaluation

We received written comments from EPA's Acting Assistant Administrator, Office of Policy, Planning and Evaluation, and EPA's Inspector General. These are included in appendixes III and IV, respectively. Overall, EPA did not agree with our recommendations. As discussed below, we believe that our recommendations are valid and should be implemented to improve the reasonableness of the legislatively required cost estimate. EPA's Inspector General commented that the issue of Superfund cost estimates raised in our report will be addressed by the Inspector General in future audits of EPA Superfund reports to the Congress and financial statements.

Regarding our first recommendation—that EPA report estimates in categories showing those currently on the NPL, those to be added over a certain period, and those to be added in the more distant future—EPA

commented that the Superfund program cannot accurately predict the number of sites that will be listed in any given fiscal year. For this reason, EPA stated its belief that it would be more appropriate to price out the present liability for cleaning up current NPL sites than to project the future liability of an NPL of uncertain size.

We agree that estimating the costs for specific sites not currently on the NPL would be highly speculative because EPA cannot determine if a particular site will be placed on the NPL until it is ranked through EPA's Hazard Ranking System. However, EPA has consistently added sites to the NPL, and there is sufficient historical evidence to indicate that NPL growth will continue. Accordingly, we believe that its comments regarding the inability of determining the number of sites that will be added during any one year focused on an unnecessary degree of precision and should not preclude EPA from factoring in costs of cleaning up additional sites.

Further, in its comments, EPA stated that historical trends and program activity levels are combined with expected program conditions to develop a comprehensive analysis of outyear Superfund program resource and funding needs. This approach can be applied to non-NPL sites as well. For example, when requested during our field work, EPA used this approach to estimate that it would cost \$11 billion to clean up 1,000 additional sites. EPA's comments do not take issue with this figure. Given the high probability, based on historical experience that additional sites will be added in the future, we believe that not recognizing the government's liability related thereto renders EPA's cost estimate report unreliable.

In commenting on our second recommendation, that EPA substantiate and document as reasonable, the factor used in preparing the estimates to reflect the growth in the cost of cleanup projects underway, EPA did not dispute that it uses an undocumented cost growth figure. EPA stated that it has only recently been able to compile and document sufficient data to conduct cost growth analyses and commented that preliminary results of an ongoing cost growth study indicate that its cost growth figure of 25 percent is reasonable. EPA officials subsequently told us that the preliminary results could substantially change.

Our review of EPA's preliminary work raised the following concerns about its reliability.

- The study was far from complete. In particular, the data EPA provided us was based on its analysis of the cost growth for 37 projects. Another 150 to

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250 projects for which detailed cost information is available are to be analyzed before the study is complete.

- The projects analyzed to date were not randomly selected, as would be necessary for the results of these analyses to be representative of the total number of projects to be included in the study.
- Only a portion of project cost growth was considered because EPA's study analyzed only project costs up to the time cleanup contracts were awarded. The analysis did not include costs through the completion of the projects.

Therefore, EPA must complete analysis of the remaining projects and assure that the methodology used is valid before the results of EPA's ongoing study could substantiate and document a reasonable cost growth factor.

In responding to our recommendation and suggestions to use certain forecast management techniques, EPA discussed several efforts underway to improve cost estimating. We believe these efforts, particularly the possibility of external review of EPA's cost estimating documentation, will significantly improve EPA's cost estimates.

Overall, EPA agreed that the CFO should have authority and responsibility for providing guidance on preparing Superfund estimates and monitoring the results and that the CFO should disclose in the Superfund financial statement overview, information on the estimated cost of hazardous waste site cleanup. However, EPA commented that this cannot be done until it develops a sophisticated cost accounting system, which will take several years. While such a new cost system would undoubtedly help in monitoring the reliability of the cost estimates, establishing the CFO's role in developing Superfund cost estimates is not dependent on this. Rather, it would require the CFO to have a guidance and oversight role in the current process EPA uses to develop Superfund cost estimates.

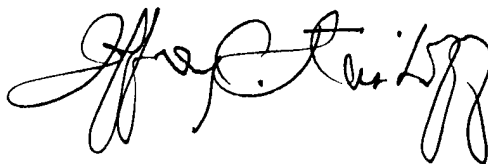
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This report contains recommendations to you. The head of a federal agency is required by 31 U.S.C. 720 to submit a written statement on actions taken on these recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

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We are sending copies of this report to the Director, Office of Management and Budget; the Secretary of the Treasury; interested congressional committees; and other interested parties. We will also make copies available to others upon request. Please contact me at (202) 275-9454 if you or your staff have any questions concerning this report. Other major contributors to this report are listed in appendix V.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Jeffrey C. Steinhoff". The signature is fluid and cursive, with the first name "Jeffrey" being the most prominent part.

Jeffrey C. Steinhoff  
Director, Civil Audits



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## Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFO	Chief Financial Officer
EPA	Environmental Protection Agency
IG	Inspector General
OMB	Office of Management and Budget
NPL	National Priorities List



# EPA's 1989 Superfund Cost Estimate

Dollars in millions

<b>Cost category</b>	<b>Amount</b>	<b>Percent</b>
Direct site work		
Removal actions (short-term) <sup>a</sup>	\$600.4	2.9
Pre-remedial work <sup>b</sup>	540.1	2.6
Engineering and design studies <sup>c</sup>	1,949.9	9.6
Remedial actions (long-term) <sup>d</sup>	5,988.4 <sup>e</sup>	29.3
Direct site support <sup>f</sup>	5,107.2	25.0
Indirect site work <sup>g</sup>	3,807.1	18.7
Program support <sup>h</sup>	2,412.4	11.8
<b>Post fiscal year 1989 estimate</b>	<b>20,405.5</b>	<b>100.0<sup>i</sup></b>
Costs through fiscal year 1989	6,015.3	
<b>Total</b>	<b>\$26,420.8</b>	

<sup>a</sup>Removal actions are short-term efforts directed at stabilizing or preventing a threat to human health and can include emergencies, such as cleaning up an overturned truck that leaks a hazardous substance.

<sup>b</sup>Pre-remedial work includes preliminary assessment, site inspection, and determination of NPL status.

<sup>c</sup>Engineering and design studies include determining the type and extent of contamination, evaluating and developing remedial alternatives, and developing the plans and specifications for a remedy.

<sup>d</sup>Remedial actions implement the selected cleanup remedy.

<sup>e</sup>Remedial action costs include a 25 percent cost growth factor.

<sup>f</sup>Direct site support includes community relations, contract management, enforcement, and settlements with potentially responsible parties.

<sup>g</sup>Indirect site work includes preliminary enforcement and cost recovery activities under CERCLA, health studies and research, and criminal casework.

<sup>h</sup>Program support includes training, community assistance grants, general and financial administration, IG audits, information management, and policy and planning activities.

<sup>i</sup>Total does not add due to rounding.

Source: Progress Toward Implementing Superfund Fiscal Year 1989, EPA Report to Congress, December 1990.

# Improving EPA's Forecast Management Process

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We identified several forecast management process elements that can improve the validity of EPA's cost estimates. This appendix discusses these elements.

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## Identifying Forecasting Errors

A critical component of forecast management is the identification of errors through comparison of cost estimates to actual reported results. We found that EPA does not systematically or formally (1) measure the reliability of its estimates by comparing its initial estimates to results or (2) compare its initial estimates to benchmarks, which are alternative forecasts used to determine the reliability of the original forecast.

EPA develops its NPL from the Comprehensive Environmental Response, Compensation, and Liability Information System, a data base of hazardous waste sites. EPA regional office staff are responsible for updating this data base and including the actual total costs for each project completed. While this was not always done in developing the fiscal year 1989 cost estimate, EPA has made some progress by requiring that current cost estimates be included in this data base for fiscal year 1990.

However, the data base does not include actual cost information, which is essential for comparisons. Even though actual total costs are available in EPA's budget accounting system, no interface exists between that system and the Comprehensive Environmental Response, Compensation, and Liability Information System.

Further, there is little formal review of either EPA's forecast methodologies or estimates. An EPA analyst said that this is because there are few analysts outside EPA who could be helpful. Also, EPA relies on the professionalism of its staff.

Cost estimating models are available for estimating individual project costs. For example, computerized cost estimating models for individual projects are available from organizations such as the Corps of Engineers. These models are similar and can be used to compare to EPA's estimates of the individual project costs. An EPA consultant makes some comparisons, but those results are not systematically reported to EPA.

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## Developing an Events Register

A critical technique for effective cost estimating is to record in an events register important events or actions which affect the estimates. EPA does not record in an events register special events, such as new legislation, that affect the input data or Superfund cost forecast results. An events register could describe the effects on EPA's cost estimates of legislation, new technology, scope changes, or other events, such as fund level changes.<sup>1</sup>

While EPA maintains a record of input data, including program assumptions, economic assumptions, and other pertinent data in developing the estimates, it could improve its estimating process with an events register. Specifically, EPA officials would use the register to review the effects historical events had upon previous estimates. They would then be able to adjust their estimates accordingly.

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## Sensitivity Analysis

EPA could make greater use of sensitivity analysis to describe the relative importance and cost impact of its assumptions. Sensitivity analysis allows analysts to assess which assumptions used in the cost estimate are the most important and what impact the changes in those assumptions have on the total cost estimate.

EPA's forecasting model has some capability for sensitivity analysis. For example, the model can be used to determine the cost impact of alternative percentages of responsible party cleanup, types of treatment, number of NPL sites, general budget levels authorized, site size, and cost assumptions. However, the model does not have the capability to evaluate other important characteristics, such as the assumed cost growth percentage.

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## Improving Quality Control

EPA does not have a structured quality control program or regulations which set standards for evaluating its Superfund cost forecast methodology, results, data management, or documentation and reporting. One effective way an organization can validate its forecast methods is to allow a group of outside experts to review and critique its methodology and work. Undergoing external review adds credibility to an organization's methodology.

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<sup>1</sup>A method for developing an events register is discussed by W. L. Gorr, "Use of Special Event Data in Government Information Systems," Public Administration Review, 46 (Nov. 1986), pp. 532-39.

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A crucial factor for external review is having well-documented work. EPA documents many of its assumptions and cost estimating methodologies in extensive reports and a users' manual. We believe EPA's documentation is adequate for understanding its methodology. Since much of EPA's forecast methodology is documented and can be replicated, EPA could provide its methodology to other analysts for an external review. However, we found little external review of EPA cost estimating activities.

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## Improvement Suggestions

Using certain forecast management processes to manage and evaluate the Superfund cost estimating process could result in more reliable estimates. Our rationale for suggesting that EPA adopt these processes is documented further in our reports, USDA's Commodity Program: The Accuracy of Budget Forecasts, (GAO/PEMD-88-8, April 21, 1988), and USDA Commodity Forecasts: Inaccuracies Found May Lead to Underestimates of Budget Outlays, (GAO/PEMD-91-24, August 13, 1991). Specific actions which EPA can take include the following.

- Routinely update the Comprehensive Environmental Response, Compensation, and Liability Information System data base with the most recent cost estimates.
- Systematically compare initial estimates made for the record of decision to subsequent updates and actuals.
- Have the Superfund cost estimating documentation and methodology externally reviewed.
- Develop an events register to demonstrate the effect of cost estimate changes.
- Make greater use of sensitivity analysis to demonstrate the effect of major assumptions, such as alternative cost growth rates and number of site additions, and to estimate costs under alternative scenarios.
- Establish regulations on how cost estimates are to be made and used for decisionmaking.

# Comments From the Environmental Protection Agency

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

MAY 20 1992

OFFICE OF  
POLICY, PLANNING AND EVALUATION

Mr. Donald H. Chapin  
Assistant Comptroller General  
Accounting and Financial Management Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Chapin:

On April 8, the General Accounting Office sent the Environmental Protection Agency (EPA) a draft report for review and comment. The report is entitled "Superfund: EPA Costs Estimates Are Not Reliable or Timely" (GAO/AFMD-92-40). Pursuant to Public Law 96-226, the Agency provides the following comments. Although Agency staff reviewed the entire report, my comments focus on the recommendations and suggestions.

#### GAO Recommendation

To improve the usefulness of estimates to complete hazardous waste site cleanup, GAO recommends that the Administrator require the Assistant Administrator for Solid Waste and Emergency Response (OSWER) to report the estimates in categories showing those currently on the National Priority List (NPL), those to be added over a certain period, such as the next 10 years, and those to be added in the more distant future.

#### EPA Response

The Superfund Program is unable to accurately predict the number of sites that will be listed in any given fiscal year. For instance, in Fiscal Years 1990 and 1991, NPL site listings were lower than prior years due to the development of the revised Hazard Ranking System (HRS). This makes projecting NPL growth highly speculative. For this reason, we believe its most appropriate to price out the present liability of the current NPL rather than project the future liability of an NPL of uncertain size.

I suggest reviewing the accuracy of a statement on page 16, "As stated earlier, EPA could certainly aggregate the costs by category, but to disregard altogether the sites which it already knows are contaminated and will be added to the list (emphasis added) greatly reduces the value of the cost estimates". In reality, as an Agency, we are unable to determine if a site will be listed on the NPL until a site is ranked through the HRS.

See comment 1.

See comment 2.

GAO Recommendation

To improve the usefulness of estimates to complete hazardous waste site cleanup, GAO recommends that the Administrator require the Assistant Administrator for OSWER to substantiate and document as reasonable, the factor used in preparing the estimates to reflect the growth in the cost of cleanup projects underway.

EPA Response

The Outyear Liability Model (OLM) currently uses a cost growth figure of 25 percent. This cost growth adjustment represents the change in the cost estimate from the Record of Decision (ROD) to Remedial Action (RA) Award of Contract. We have only recently been able to compile and document sufficient data to conduct cost growth analyses. The preliminary findings show a cost growth figure of 23 percent. Therefore, we believe that a cost growth figure of 25 percent is reasonable.

The GAO report cites an EPA analyst who suggests that a "... better estimate would be 50 to 75 percent. . ." This statement was the analyst's opinion based on the results of the University of Tennessee (UT) study which found a 75 percent cost growth factor. The UT study, however, was based on an examination of predominately Department of Energy and Department of Defense sites, whose size and complexity often dwarf all but the worst civilian sites. Cost estimates at the ROD stage for complex sites may be less accurate. For this reason, we believe that the UT study findings, though appropriate for the sites studied, would not be applicable to Superfund NPL sites. Applying the 75 percent cost growth factor to all Superfund sites would be the equivalent of basing the entire cost estimate on our "mega-site" experience. Therefore, we believe that the 25 percent average cost growth estimate is appropriate for Superfund sites.

GAO Recommendation

To improve the usefulness of estimates to complete hazardous waste site cleanup, GAO recommends that the Administrator require the Assistant Administrator for OSWER to use forecast management practices, such as identifying forecast errors in developing the estimates.

See comment 1.

See comment 2.

Appendix III  
Comments From the Environmental  
Protection Agency

See comment 3.

EPA Response

Generally, OLM is not designed to provide accurate annual estimates. The Model combines historical trends and program activity levels with expected program conditions to develop a comprehensive analysis of outyear Superfund program resource and funding needs. Therefore, it is not appropriate to compare initial annual estimates toward an outyear resource need (generated by the OLM) to actual annual results.

GAO Recommendation

To help ensure the reliability and timeliness of Superfund cost estimates, GAO recommends that the Administrator (1) provide the Chief Financial Officer (CFO) authority and responsibility, as envisioned in the CFO Act, for providing guidance on preparing the estimates and monitoring the results and (2) direct the CFO to disclose in the Superfund financial statement overview, information on the estimated cost of hazardous waste site cleanup.

EPA Response

See comment 1.

The Agency agrees with the thrust of the recommendation regarding the role of the Chief Financial Officer in providing guidance on the preparation of estimates for the future costs of Superfund cleanups. We would also agree that monitoring the results of the cost estimates is an appropriate role for the CFO.

Although EPA agrees conceptually with the recommendation, implementation can only be achieved by developing a sophisticated cost accounting system; such a system will entail a significant investment of resources for acquisition and development as well as the recruitment and training of qualified staff. A comprehensive, reliable cost accounting system and the analytical capability to effectively monitor performance is a long-term goal of our CFO implementation plan. However, the Agency has limited resources available to accomplish this plan given competing Agency priorities. Consequently, our general agreement with these recommendations will not translate into actual implementation for several years contingent on availability of sufficient resources.

Appendix III  
Comments From the Environmental  
Protection Agency

See comment 1.

The Superfund program has several improvement initiatives underway to improve cost estimating. These activities support suggestions on page 33 of the draft report.

Suggestion 1: Routinely update the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) data base with the most recent cost estimates.

OSWER Action: The Regions are responsible and required to maintain cost estimate information in CERCLIS on a timely and accurate basis. Quarterly funding is withheld until such data is complete.

Suggestion 2: Systematically compare initial estimates made for the record of decision to subsequent updates and actual.

Program Action: We have been and will continue to update the Cost Growth Analysis using the most current ROD and RA cost estimates.

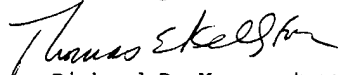
Suggestion 3: Have the Superfund cost estimating documentation and methodology externally reviewed.

Program Action: The Superfund Program is currently undertaking an analysis of Superfund Program resource needs and funding alternatives. An external review of the Model's cost estimating documentation may be conducted to strengthen the credibility of its estimates.

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I appreciate the opportunity to respond to this draft report.

Sincerely,



Richard D. Morgenstern  
Acting Assistant Administrator

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The following are GAO's comments on the Environmental Protection Agency's letter dated May 20, 1992.

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## **GAO Comments**

1. Discussed in agency comments section of report.
2. We have modified the report to reflect EPA's comment.
3. Discussed in agency comments section of report. Also, while EPA stated that it was not acceptable to compare initial actual estimates to actual results, it did not take exception to our suggestion to systematically identify forecast errors by comparing estimates to actual results.

# Comments From the Environmental Protection Agency's Office of Inspector General

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

MAY 8 1992

THE INSPECTOR GENERAL

Mr. Donald H. Chapin  
Assistant Comptroller General  
General Accounting Office  
Washington, D.C. 20548

Dear Mr. Chapin:

This is in response to your letter of April 8, 1992, requesting our comments on the draft audit report entitled, "Superfund - EPA Cost Estimates are not Reliable or Timely." This report has raised an issue that we will be addressing in our audits of EPA's Reports to Congress as well as the Superfund financial statements.

We appreciate the opportunity to comment on this document and look forward to continuing to work together on financial statement audit issues. Should your staff have any questions, please have them contact Kenneth A. Konz, Assistant Inspector General for Audit, on (202) 260-1106.

Sincerely,

A handwritten signature in cursive script, appearing to read "John C. Martin".  
John C. Martin

See comment 1.

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**Appendix IV  
Comments From the Environmental  
Protection Agency's Office of Inspector  
General**

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The following are GAO's comments on the Environmental Protection Agency's Inspector's General letter dated May 8, 1992.

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**GAO Comments**

1. Discussed in agency comments section of report.

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# Major Contributors to This Report

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Schroeder, Brett R. and Ralph Shangraw. "Parametric Tools for Hazardous Waste Cleanup Projects." American Association of Cost Engineers Transactions. 1990, pp. J2.1-J2.5.



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# Related GAO Products

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Crop Insurance: Inaccurate FCIC Price Forecasts Increase Program Costs  
(GAO/PEMD-92-4, Dec. 13, 1991).

USDA Commodity Forecasts: Inaccuracies Found May Lead to Underestimates of Budget Outlays (GAO/PEMD-91-24, Aug. 13, 1991).

Short-Term Forecasting: Accuracy of USDA's Meat Forecasts and Estimates  
(GAO/PEMD-91-16, May 6, 1991).

USDA's Commodity Program: The Accuracy of Budget Forecasts  
(GAO/PEMD-88-8, Apr. 21, 1988).

Superfund: Cost Growth on Remedial Construction Activities  
(GAO/RCED-88-69, Feb. 24, 1988).

Superfund: Extent of Nation's Potential Hazardous Waste Problem Still Unknown (GAO/RCED-88-44, Dec. 17, 1987).

EPA's Inventory of Potential Hazardous Waste Sites Is Incomplete  
(GAO/RCED-86-75, March 26, 1985).